Automotive Technology

Program of Studies
2015-2016

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Automotive Technology Courses

Course Title	Post-Secondary Connection	Valid Course Code	Recommended Grade Level							Recommended Credit
			6	7	8	9	10	11	12	
A/C Climate Control	ADX 170	470547						X	X	1
Auto Trans/Transaxle	AUT180	470570						X	X	1
Automobile Service Technology Section A	ADX 120-121	470515						X	X	1
Automobile Service Technology Section B	ADX 120-121	470517						X	X	1
Automobile Service Technology Section C	ADX 120-121	470519						X	X	1
Automobile Service Technology Section D	ADX 120-121	470521						X	X	1
Automotive Maintenance and Light Repair Section A	ADX 120-121	470507						X	X	1
Automotive Maintenance and Light Repair Section B	ADX 120-121	470509						X	X	1
Automotive Maintenance and Light Repair Section C	ADX 120-121	470511						X	X	1
Automotive Maintenance and Light Repair Section D	ADX 120-121	470513						X	X	1
Basic Auto Electricity	ADX 120-121	470556					X	X	X	1
Basic Fuel & Ignition Sys	AUT 140-141	470558						X	X	1
Brake Systems	AUT 110-111	470550						X	X	1
Computer Control Systems	AUT 240-241	470560						X	X	1
Electrical Systems	ADX 260-261	470562						X	X	1
Emission Sys	AUT 142-143	470564						X	X	1
Engine Repair	ADX 150-151	470580						X	X	1
Manual Transmission	AUT 130-131	470582						X	X	1
Master Automobile Service Technology Section A	*	470523							X	1
Master Automobile Service Technology Section B	*	470525							X	1
Suspension & Steering	AUT 160	470553						X	X	1
Co-Op I (Auto)	AUT 199	470501						X	X	1
Industrial Safety	ISX 100	460301					X	X	X	.5
Personal Financial Mgmt	BAS 120	060170				X	X	X	X	.5
Automotive Internship I	AUT 198	470504						X	X	1
Precision Measurement	PMX 100	470546					X	X	X	.5
Shop Management	SMX 100	470301					X	X	X	.5
Special Problems I (Auto)	AUT 290	470577						X	X	1

Special Problems II (Auto)	AUT 291	470578						X	X	1
Special Problems III (Auto)	AUT 292	470579						X	X	1
Special Problems IV(Auto)	*	470584						X	X	1
Workplace Principles	WPP 200	060191				X	X	X	X	.5

AUTOMOTIVE TECHNOLOGY EDUCATION

Overview of Automotive Technology Education

Purpose:
The vision of Kentucky Automotive Technology Education is to promote safety standards and performance standards, enhance leadership, provide relevant curriculum, and to be vital to the education of all students.
Kentucky Automotive Technology Education will:

- Operate as the center for nationally recognized industry standard training.
- Provide a critical link in school to employment or postsecondary education.
- Develop stronger relationships with the community in terms of mutual advocacy, cooperative field experiences, employment placement, and support for relevant student organizations and competitions
- Represent an important component in the education of all students.
- Require and promote critical thinking and problem solving.
- Offer an up to date curriculum based on standards that adapts to changes in the industry.
- Integrate academic skills into the Automotive Technology Education Curriculum in order to insure that students develop written & verbal communications skills, computational skills, and scientific/math problem-solving skills.

Career Pathways:

- *Automotive Maintenance and Light Repair Technician*
- *Automobile Service Technician*
- *Master Automobile Service Technician*
- *Entry Level Automobile Technician*

Standard Based Curriculum
The curriculum is composed of industry standards based competencies/tasks. Therefore, the teaching/learning focus is on the final results rather than the process.

Kentucky Occupational Skill Standards
The Kentucky Occupational Skill Standards are the performance specifications that identify the knowledge, skills, and abilities an individual needs to succeed in the workplace. Identifying the necessary skills is critical to preparing students for entry into employment or post-secondary education. These standards described the necessary **occupational, academic,** and **employability** skills needed to enter the workforce or post- secondary education in specific career areas. There is an ongoing effort to continue to refine these standards by which exemplary Transportation Education Programs are evaluated and certified. This helps insure that curriculum meets industry specifications.

Work Based Learning
Cooperative experience, internships, shadowing and mentoring opportunities provide depth and breadth of learning in the instructional program and allow students to apply the concepts learned in the classroom. The Work Based Learning Guide is available on the KDE webpage: www.education.ky.gov.

Student Organizations and Competitions
Participation in Skills USA and the Ford AAA Auto Skills Competition provides a vehicle for students to employ higher order thinking skills, to interact with high-level industry people and to further enhance their leadership skill through their participation in regional, state and national competitive events and local activities

AUTOMOTIVE EDUCATION CAREER PATHWAYS
2015-2016

AUTOMOTIVE MAINTENANCE AND LIGHT REPAIR TECHNICIAN
CIP 47.0604.01

PATHWAY DESCRIPTION: A program that prepares individuals to apply technical knowledge and skills to repair, service, and maintain all types of automobiles. Includes instruction in brake systems, electrical systems, engine performance, engine repair, suspension and steering, automatic and manual transmissions and drive trains, and heating and air condition systems.

BEST PRACTICE CORE	**EXAMPLE ILP-RELATED CAREER TITLES**
Foundational Skills Necessary for Career-Ready Measure: (KOSSA/Industry Certification) *Complete **(4) FOUR CREDITS** from the following:* • 470507 Automotive Maintenance and Light Repair Section A and Lab • 470509 Automotive Maintenance and Light Repair Section B and Lab • 470511 Automotive Maintenance and Light Repair Section C and Lab • 470513 Automotive Maintenance and Light Repair Section D and Lab These courses can be taken in ANY order. There are NO prerequisites required to enter these classes. Example: "Section "D" can be taken before Section "A". "Section "C" can be taken before Section "B".	Entry Level Auto Technician Service Advisor Dispatcher Warranty Clerk Auto Sales Rep Service Manager

AUTOMOTIVE EDUCATION CAREER PATHWAYS
2015-2016

AUTOMOBILE SERVICE TECHNICIAN
CIP Code: 47.0604.02

PATHWAY DESCRIPTION: A program that prepares individuals to apply technical knowledge and skills to repair, service, and maintain all types of automobiles. Includes instruction in brake systems, electrical systems, engine performance, engine repair, suspension and steering, automatic and manual transmissions and drive trains, and heating and air condition systems.

BEST PRACTICE CORE	**EXAMPLE ILP-RELATED CAREER TITLES**
Foundational Skills Necessary for Career-Ready Measure: (KOSSA/Industry Certification) *Complete **(4) FOUR CREDITS** from the Automobile Maintenance and Light Repair Technician Pathway* *Complete **(4) FOUR CREDITS** from the following:* • 470515 Automobile Service Technology Section A and Lab • 470517 Automobile Service Technology Section B and Lab • 470519 Automobile Service Technology Section C and Lab • 470521 Automobile Service Technology Section D and Lab These courses can be taken in ANY order. Example: "Section "D" can be taken before Section "A. "Section "C" can be taken before Section "B"	Auto Technician/Line Technician Service Advisor Dispatcher Warranty Clerk Auto Sales Rep Shop Foreman Service Manager

AUTOMOTIVE EDUCATION CAREER PATHWAYS
2015-2016

MASTER AUTOMOBILE SERVICE TECHNICIAN
CIP Code: 47.0604.03

PATHWAY DESCRIPTION: A program that prepares individuals to apply technical knowledge and skills to repair, service, and maintain all types of automobiles. Includes instruction in brake systems, electrical systems, engine performance, engine repair, suspension and steering, automatic and manual transmissions and drive trains, and heating and air condition systems.

BEST PRACTICE CORE	**EXAMPLE ILP-RELATED CAREER TITLES**
Foundational Skills Necessary for Career-Ready Measure: (KOSSA/Industry Certification) *Complete **(8) EIGHT CREDITS** in the Automobile Maintenance and Light Repair Technician Pathway AND the Automobile Service Technology Pathway.* *Complete **(2) TWO CREDITS** from the following:* • 470523 Master Automobile Service Technology Section A and Lab • 470525 Master Automobile Service Technology Section B and Lab These Master Automobile Service Technology courses can be taken in ANY order. Example: "Section "B" can be taken before Section "A".	Auto Technician/Line Technician/Specialty Technician Service Advisor Dispatcher Warranty Clerk Auto Sales Rep Shop Foreman Auto Field Engineer Auto Instructor Service Manager

AUTOMOTIVE EDUCATION CAREER PATHWAYS
2015-2016

ENTRY LEVEL BRAKES AND SUSPENSION TECHNICIAN
(Option only available for Programs Still Certified under the 2008 ASE/NATEF Standards.)
CIP Code: 47.0604.04

PATHWAY DESCRIPTION: A program that prepares individuals to apply technical knowledge and skills to repair, service, and maintain all types of automobiles. Includes instruction in brake systems, electrical systems, and suspension and steering systems

BEST PRACTICE CORE	**ILP-RELATED CAREER TITLES**
Foundational Skills Necessary for Career-Ready Measure: (KOSSA/Industry Certification) *Complete **(3) THREE CREDITS** from the following:* • 470550 Brakes and Lab • 470553 Suspension and Steering and Lab • 470556 Basic Automotive Electricity and Lab Note: The above courses in this Pathway may be taken in any order (Basic Automotive Electricity and Lab is a prerequisite to Electrical Systems and Lab) *Complete **(1) ONE CREDIT** from the following:* • 470562 Electrical Systems and Lab	Brake Technician Front End Technician Brake and Suspension Technician Auto Electric Technician Service Advisor Dispatcher Warranty Clerk Auto Sales Rep Shop Foreman Service Manager

AUTOMOTIVE EDUCATION CAREER PATHWAYS
2015-2016

ENTRY LEVEL ENGINE PERFORMANCE TECHNICIAN
(Option only available for Programs Still Certified under the 2008 ASE/NATEF Standards)
CIP Code: 47.0604.05

PATHWAY DESCRIPTION: A program that prepares individuals to apply technical knowledge and skills to repair, service, and maintain all types of automobiles. Includes instruction in electrical systems, engine performance, and engine repair systems

BEST PRACTICE CORE	**EXAMPLE ILP-RELATED CAREER TITLES**
Foundational Skills Necessary for Career-Ready Measure: (KOSSA/Industry Certification) *Complete **(1) ONE CREDIT** from the following as prerequisite for pathway:* • 470556 Basic Automotive Electricity and Lab *Complete **(4) FOUR CREDITS** from the following:* • 470562 Electrical Systems and Lab • 470558 Basic Fuel and Ignition Systems and Lab • 470564 Emission Systems Lab • 470560 Computer Control Systems and Lab Note: The Courses in this Pathway may be taken in any order.	Drivability Technician Auto Electric Technician Auto Engine Repair Technician Service Advisor Dispatcher Warranty Clerk Auto Sales Rep Shop Foreman Service Manager

AUTOMOTIVE EDUCATION CAREER PATHWAYS
2015-2016

AUTOMOTIVE ENGINEERING/AUTOMOTIVE MAINTENANCE AND LIGHT REPAIR
CIP Code: 15.0803.00

PATHWAY DESCRIPTION: A program that prepares individuals to apply basic engineering principles and technical skills in support of engineers and other professionals engaged in developing, manufacturing and testing self-propelled ground vehicles and their systems. Includes instruction in vehicular systems technology, design and development testing, prototype and operational testing, inspection and maintenance procedures, instrument calibration, test equipment operation and maintenance, and report preparation.

BEST PRACTICE CORE	**EXAMPLE ILP-RELATED CAREER TITLES**
Foundational Skills Necessary for Career-Ready Measure: (KOSSA/Industry Certification) *Complete **(2) TWO CREDITS** from the following as prerequisite to the pathway:* • 219901 Introduction to Engineering Design (PLTW) • 219903 Digital Electronics (PLTW) *Complete **(4) FOUR CREDITS** from the following:* • 470507 Automotive Maintenance and Light Repair Section A and Lab • 470509 Automotive Maintenance and Light Repair Section B and Lab • 470511 Automotive Maintenance and Light Repair Section C and Lab • 470513 Automotive Maintenance and Light Repair Section D and Lab Note: (PLTW) courses require an agreement between Project Lead the Way and the District.	Automotive Engineer Service Advisor Dispatcher Warranty Clerk Auto Sales Rep Service Manager

Advanced Coursework for Automotive Technology
1. Advanced course may be taken upon completion of a career pathway, but will not be considered credit for Preparatory or Completer status. 2. Additional Co-op placement may be taken in conjunction with Advanced Courses.
470580 Engine Repair and Lab
470547 Climate Control and Lab
470570 Automatic Transmission/Transaxle and Lab
470582 Manual Drivetrains and Axles and Lab
470501 Co-Op I
460301 Industrial Safety
060170 Personal Financial Management
470504 Automotive Internship I
470546 Precision Measurement
470301 Shop Management
470577 Special Problems I (Auto)
470578 Special Problems II (Auto)
470579 Special Problems III (Auto)
470584 Special Problems IV (Auto)
060191 Workplace Principles

KENTUCKY CAREER PATHWAY/PROGRAM OF STUDY TEMPLATE

Standard 5A - Career Pathway

COLLEGE/UNIVERSITY: _____

CLUSTER: Transportation

PATHWAY: Automotive

HIGH SCHOOL (S): _____

PROGRAM: Automotive

GRADE	ENGLISH	MATH	SCIENCE	SOCIAL STUDIES	REQUIRED COURSES / RECOMMENDED ELECTIVE COURSES / OTHER ELECTIVE COURSES / CAREER AND TECHNICAL EDUCATION COURSES			CREDENTIAL CERTIFICATE DIPLOMA DEGREE	Sample Occupations
9	English I	Algebra I	Life Science	Economics	Foreign Language 1	Health and PE	Computer Applications		
10	English II	Geometry	Earth and Space Science	U.S. History	Physics	Health and PE	Foreign Language 2		
11	English III	Algebra II	Physical Science	World Geography	AUT 150-151 Automotive Maintenance and Light Repair and Lab Section A	AUT 152-153 Automotive Maintenance and Light Repair and Lab Section B	WPP 200 Workplace Principles		Work Based Learning
12	English IV	4th Math	Health & PE	History and Appreciation of Visual and Performing Arts	AUT 154-155 Automotive Maintenance and Light Repair and Lab Section C	AUT 155-157 Automotive Maintenance and Light Repair and Lab Section D	AUT 290 Special Problems	ASE Student Certification/Maintenance and Light Repair.	Entry Level Auto Technician, Line Technician, Service Writer.
	Take Compass test - Apply for admission to KCTCS				Student eligible to take ASE exams			*Denotes ONet Certificates	
Year 13	Writing	Math	Science	Computer Applications	AUT 110 & 111 Brake Systems/ ADX 120 & 121 Basic Automotive Electricity	ADX 260 & 261 Electrical Systems/ADX 150 & 151 Engine Repair	ADX 170&171 Climate Control/AUT 199 Co-Op		
Year 14	Oral Communication	Elective	Humanities	Social Interaction	AUT 160 & 161 Suspension and Steering/AUT 130 & 131 Manual Transmissions and Lab •	AUT 140 & 141 Basic Fuel and Ignition Systems/AUT 180 & 181 Automatic Transmissions and Lab •	AUT 240 & 241 Computer Control Systems/AUT 140 & 141 Emission Systems	Associate of Applied Science in Automotive Technology	Entry Level Auto Technician, Line Technician, Specialty Technician, Service Writer, Dispatcher, Shop Foreman
Years 15-18	Two years of verifiable work experience - Study for, take and pass ASE exams.							ASE Professional/Industry Certification	Entry Level Auto Technician, Line Technician, Specialty Technician, Service Writer, Dispatcher, Shop Foreman, Service Manager
Year 19	Apply for admission to University - Plan a bachelor's degree program - Complete Kentucky Teacher Internship Program								
Years 19-	Complete college work toward the bachelor's degree Professional Education Courses (31 hours)				Intro to Education	Foundations of CTE	Methods of Teaching		
	At least 6 hours each year to maintain teaching certificate Maintain industry ASE certifications				Instructional Methods	Evaluation	Human Development		
					Special Education	Student Teaching			
	Related/Technical Courses (33 hours)				Digital Electricity	DC and AC	NOCTI Test		
	43 hours must be in 300 or above level courses				PC Related	PC Networking	Quality Control		
					Methods and Processes	Hydraulics and Pneumatics	CAD		
					PLCs				Bachelor's Degree

Required Courses

Recommended Elective Courses

Other Elective Courses

Required Career and Technical Education Courses

Credit-Based Transition Programs (e.g. Dual/Concurrent Enrollment, Articulated Courses, 2+2+2)

(◆ =High School to Comm. College) (• =Com. College to 4-Yr Institution) (■ = Opportunity to test out)

Mandatory Assessments, Advising, and Additional Preparation

Note: Categories of courses (e.g. Required, Recommended Electives, other Electives and career and Technical Education) apply to both secondary and postsecondary levels.

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Sample Automotive Technology Pathway

Automotive Technology Course Descriptions and Tasks

Basic Automotive Electricity and Lab
Valid Course Codes:
Class: 470556

Course Description

This course introduces the student to the principles, theories, and concepts of the automotive electrical system that include the unique diagramming, coding and locating of wiring, and component devices. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Students Will:

1. Complete Work Order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret electrical/electronic system concern; determine necessary action.
3. Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).
6. Use wiring diagrams during diagnosis of electrical circuit problems.
7. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including: source voltage, voltage drop, current flow, and resistance.
8. Check electrical circuits with a test light; determine necessary action.
9. Check electrical circuits using fused jumper wires; determine necessary action.
10. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.
11. Measure and diagnose the cause(s) of excessive parasitic draw; determine necessary action.

12. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.

13. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action.

14. Remove and replace terminal end from connector; replace connectors and terminal ends.

15. Repair wiring harness (including CAN/BUS systems).

16. Perform solder repair of electrical wiring.

17. Identify location of hybrid vehicle high voltage circuit disconnect (service plug) location and safety procedures

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS ADX 120-121
*CTSO's – Skills USA/Ford AAA

Engine Repair and Lab
Valid Course Codes:
Class: 470580

Course Description

This course provides a series of lectures and demonstrations on the fundamentals of engine repair, troubleshooting, and engine operation and maintenance. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Students Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret engine concern; determine necessary action.
3. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
6. Diagnose engine noises and vibrations; determine necessary action.
7. Diagnose the cause of excessive oil consumption, coolant consumption, unusual engine exhaust color and odor; determine necessary action.
8. Perform engine vacuum tests; determine necessary action.
9. Perform cylinder power balance tests; determine necessary action.
10. Perform cylinder cranking and running compression tests; determine necessary action.
11. Perform cylinder leakage tests; determine necessary action.
12. Remove and reinstall engine in an OBD II or newer vehicle; reconnect all attaching components and restore the vehicle to running condition.
13. Install engine covers using gaskets, seals and sealers as required.
14. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.
15. Inspect, remove and replace engine mounts.

16. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedure.

17. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.

18. Inspect valve springs for squareness and free height comparison; determine necessary action.

19. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action.

20. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action.

21. Inspect valves and valve seats; determine necessary action.

22. Check valve spring assembled height and valve stem height; determine necessary action.

23. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action.

24. Inspect valve lifters; determine necessary action.

25. Adjust valves (mechanical or hydraulic lifters).

26. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components)

27. Inspect and/or measure camshaft for runout, journal wear and lobe wear.

28. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action.

29. Establish camshaft position sensor indexing.

30. Disassemble engine block; clean and prepare components for inspection and reassembly.

31. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action.

32. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action.

33. Deglaze and clean cylinder walls.

34. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.

35. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action

36. Inspect main and connecting rod bearings for damage and wear; determine necessary action.

37. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action.

38. Inspect and measure piston skirts and ring lands; determine necessary action.

39. Remove and replace piston pin.

40. Determine piston-to-bore clearance.

41. Inspect, measure, and install piston rings.

42. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time.

43. Remove, inspect or replace crankshaft vibration damper (harmonic balancer).

44. Assemble engine block.

45. Perform oil pressure tests; determine necessary action.

46. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.

47. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action.

48. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.

49. Inspect and replace engine cooling and heater system hoses.

50. Inspect, test, and replace thermostat and gasket/seal.

51. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.

52. Inspect, remove and replace water pump.

53. Remove and replace radiator.

54. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams.

55. Inspect auxiliary coolers; determine necessary action.

56. Inspect, test, and replace oil temperature and pressure switches and sensors.

57. Perform oil and filter change.

58. Identify causes of engine overheating.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS ADX 150-151
*CTSO's – Skills USA/Ford AAA

A/C Climate Control and Lab
Valid Course Codes:
Class: 470547

Course Description

This course introduces the theory and operation of heating and air conditioning systems. Air conditioning terminology and how to service and troubleshoot mechanical and electrical circuits of heating and air conditioning systems are emphasized. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Students Will:

1. Complete work order to include information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret heating and air conditioning concern; determine necessary action.
3. Research applicable vehicle and service information, such as heating and air conditioning system operation, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Performance test A/C system; identify A/C system malfunctions.
6. Identify abnormal operating noises in the A/C system; determine necessary action.
7. Identify refrigerant type; select and connect proper gauge set; record temperature and pressure readings.
8. Leak test A/C system; determine necessary action.
9. Inspect the condition of refrigerant oil removed from the system; determine necessary action.
10. Determine recommended oil and oil capacity for system application.
11. Using scan tool, observe and record related HVAC data and trouble codes.
12. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action.
13. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action.
14. Inspect, test, and/or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap and adjust as needed.

15. Remove, inspect, and reinstall A/C compressor and mountings; determine required oil quantity.
16. Identify hybrid vehicle A/C system electrical circuits, service and safety precautions.
17. Determine the need for an additional A/C system filter; perform necessary action.
18. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action.
19. Inspect A/C condenser for airflow restrictions; perform necessary action.
20. Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine required oil quantity.
21. Remove, inspect, and install expansion valve or orifice (expansion) tube.
22. Inspect evaporator housing water drain; perform necessary action.
23. Remove, inspect, and reinstall evaporator; determine required oil quantity.
24. Remove, inspect, and reinstall condenser; required oil quantity.
25. Diagnose temperature control problems in the heater/ventilation system; determine necessary action.
26. Perform cooling system pressure tests; check coolant condition, inspect and test radiator, cap (pressure/vacuum), coolant recovery tank, and hoses; perform necessary action.
27. Inspect engine cooling and heater system hoses and belts; perform necessary action.
28. Inspect, test, and replace thermostat and gasket/seal.
29. Determine coolant condition and coolant type for vehicle application; drain and recover coolant.
30. Flush system; refill system with recommended coolant; bleed system.
31. Inspect and test cooling fan, fan clutch, fan shroud, and air dams; perform necessary action.
32. Inspect and test electric cooling fan, fan control system and circuits; determine necessary action.
33. Inspect and test heater control valve(s); perform necessary action.
34. Remove, inspect, and reinstall heater core.
35. Diagnose malfunctions in the electrical controls of heating, ventilation, and A/C (HVAC) systems; determine necessary action.
36. Inspect and test A/C-heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary action.
37. Test and diagnose A/C compressor clutch control systems; determine necessary action.

38. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.

39. Inspect and test A/C-heater control panel assembly; determine necessary action.

40. Inspect and test A/C-heater control cables, motors, and linkages; perform necessary action.

41. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action.

42. Identify the source of A/C system odors.

43. Check operation of automatic or semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action.

44. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards.

45. Identify and recover A/C system refrigerant.

46. Recycle, label, and store refrigerant.

47. Evacuate and charge A/C system; add refrigerant oil as required.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS ADX 170-171
*CTSO's – Skills USA/Ford AAA

Electrical Systems and Lab
Valid Course Codes:
Class: 470562

Course Description

This course focuses on the theory and principles relating to automotive electrical/electronic components. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Students Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret electrical/electronic system concern; determine necessary action.
3. Research applicable vehicle and service information such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs.
6. Perform battery state-of-charge test; determine necessary action.
7. Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.
8. Maintain or restore electronic memory functions.
9. Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps, and hold-downs.
10. Perform battery charge.
11. Start a vehicle using jumper cables or an auxiliary power supply.
12. Identify high voltage circuits of electric or hybrid electric vehicle and related safety precautions.
13. Identify electronic modules, security systems, radios, and other accessories that require reinitialization or code entry following battery disconnect.
14. Identify hybrid vehicle auxiliary (12v) battery service, repair and test procedures.
15. Perform starter current draw tests; determine necessary action.

16. Perform starter circuit voltage drop tests; determine necessary action.
17. Inspect and test starter relays and solenoids; determine necessary action.
18. Remove and install starter in a vehicle.
19. Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.
20. Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.
21. Perform charging system output test; determine necessary action.
22. Diagnose charging system for the cause of undercharge, no-charge and overcharge conditions.
23. Inspect, adjust, or replace generator (alternator) drive belts pulleys, and tensioners; check pulley and belt alignment; replace as needed.
24. Remove, inspect, and install generator (alternator).
25. Perform charging circuit voltage drop tests; determine necessary action.
26. Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.
27. Inspect, replace, and aim headlights and bulbs.
28. Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action.
29. Identify system voltage and safety precautions associated with high intensity discharge headlights.
30. Inspect and test gauges and gauge sending units for cause of abnormal gauge readings; determine necessary action.
31. Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action.
32. Diagnose the cause of incorrect operation of warning devices and other drive information systems; determine necessary action.
33. Inspect and test sensors, connectors, and wires of electronic (digital) instrument circuits; determine necessary action.
34. Diagnose incorrect horn operation; perform necessary action.
35. Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.
36. Diagnose incorrect washer operation; perform necessary action.
37. Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.
38. Diagnose incorrect heated glass, mirror, or seat operation; determine necessary action.

39. Diagnose incorrect electric lock operation (including remote keyless entry); determine necessary action.

40. Diagnose incorrect operation of cruise control systems; determine necessary action.

41. Diagnose supplemental restraint system (SRS) concerns; determine necessary action.

42. Disarm and enable the airbag system for vehicle service.

43. Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action.

44. Remove and reinstall door panel.

45. Diagnose body electronic system circuits using a scan tool; determine necessary action.

46. Check for module communication (including CAN/BUS systems) errors using a scan tool.

47. Diagnose the cause of false, intermittent, or no operation of anti-theft system.

48. Describe the operation of keyless entry/remote-start systems.

49. Perform software transfers, software updates, or flash reprogramming on electronic modules.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS ADX 260-261
*CTSO's – Skills USA/Ford AAA

Brake Systems and Lab
Valid Course Code:
Class: 470550

Course Description

This course involves the operational theory and application of hydraulic and anti-lock brake systems; disc and drum brakes are discussed. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Students Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret brake system concern; determine necessary action.
3. Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).
6. Measure brake pedal height, travel, and free play (as applicable); determine necessary action.
7. Check master cylinder for internal/external leaks and proper operation; determine necessary action.
8. Remove, bench bleed, and reinstall master cylinder.
9. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action.
10. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action.
11. Replace brake lines, hoses, fittings, and supports.
12. Indicate brake lines using proper material and flaring procedures (double flare and ISO types).
13. Select, handle, store, and fill brake fluids to proper level.
14. Inspect, test, and/or replace metering (hold-off), proportioning (balance), pressure differential, and combination valves.

15. Inspect, test, and/or replace components of brake warning light system.
16. Bleed and/or flush brake system.
17. Test brake fluid for contamination.
18. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action (Drum Brakes).
19. Remove, clean, inspect, and measure brake drums; determine necessary action.
20. Refinish brake drum; measure final drum diameter.
21. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.
22. Inspect and install wheel cylinders.
23. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings.
24. Install wheel, torque lug nuts, and make final checks and adjustments.
25. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pulsation concerns; determine necessary action (Disc Brakes).
26. Remove caliper assembly; inspect for leaks and damage to caliper housing; determine necessary action.
27. Clean and inspect caliper mounting and slides/pins for operation, wear, and damage; determine necessary action.
28. Remove, inspect and replace pads and retaining hardware; determine necessary action.
29. Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts.
30. Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks.
31. Clean, inspect, and measure rotor thickness, lateral runout, and thickness variation; determine necessary action
32. Remove and reinstall rotor.
33. Refinish rotor on vehicle; measure final rotor thickness.
34. Refinish rotor off vehicle; measure final rotor thickness.
35. Retract caliper piston on an integrated parking brake system.
36. Install wheel, torque lug nuts, and make final checks and adjustments.
37. Check brake pad wear indicator system operation; determine necessary action.
38. Test pedal free travel; check power assist operation.
39. Check vacuum supply to vacuum-type power booster.

40. Inspect the vacuum-type power booster unit for leaks; inspect the check valve for proper operation; determine necessary action.

41. Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine necessary action.

42. Measure and adjust master cylinder pushrod length.

43. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action.

44. Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust bearings.

45. Check parking brake cables and components for wear, binding, and corrosion; clean, lubricate, adjust or replace as needed.

46. Check parking brake and indicator light system operation; determine necessary action.

47. Check operation of brake stop light system; determine necessary action.

48. Replace wheel bearing and race.

49. Inspect and replace wheel studs.

50. Remove and reinstall sealed wheel bearing assembly.

51. Identify and inspect electronic brake control system components; determine necessary action.

52. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system ; determine necessary action.

53. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action.

54. Depressurize high-pressure components of the electronic brake control system.

55. Bleed the electronic brake control system hydraulic circuits.

56. Remove and install electronic brake control system electrical/electronic and hydraulic components.

57. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data).

58. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.).

59. Identify traction control/vehicle stability control system components.

60. Describe the operation of a regenerative braking system.

Connections:
*Common Core State Standards *KOSSA *Common Core Technical Standards *New Generation Science Standards *Post-Secondary: KCTCS AUT 110-111 *CTSO's – Skills USA/Ford AAA

Manual Transmissions
Valid Course Code:
Class: 470582

Course Description

This course involves an in-depth study of principles of operation, construction, and service of manual transmissions and related drive train components (differentials, clutches, u-joints, rear wheel drive and 4-wheel drive). It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task; 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Process

Students Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret drive train concern; determine necessary action.
3. Research applicable vehicle and service information, such as drive train system operation, fluid type, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Diagnose fluid loss, level, and condition concerns; determine necessary action.
6. Drain and fill manual transmission/transaxle and final drive unit.
7. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.
8. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action.
9. Inspect hydraulic clutch slave and master cylinders, lines, and hoses; determine necessary action.
10. Inspect and replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing and linkage, and pilot bearing/bushing (as applicable).
11. Bleed clutch hydraulic system.
12. Inspect flywheel and ring gear for wear and cracks; determine necessary action.
13. Inspect engine block, core plugs, rear main engine oil seal, clutch (bell) housing, transmission/transaxle case mating surfaces, and alignment dowels; determine necessary action.
14. Measure flywheel runout and crankshaft end play; determine necessary action.

15. Remove and reinstall transmission/transaxle.
16. Disassemble, clean, and reassemble transmission/transaxle components.
17. Inspect transmission/transaxle case, extension housing, and case mating surfaces, bores, bushings, and vents; perform necessary action.
18. Diagnose noise concerns using transmission/transaxle powerflow principles.
19. Diagnose hard shifting and jumping out of gear concerns; determine necessary action.
20. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers.
21. Inspect, replace, and align powertrain mounts.
22. Inspect and replace gaskets, seals, and sealants; inspect sealing surfaces.
23. Remove and replace transaxle final drive.
24. Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs.
25. Measure end play or preload (shim or spacer selection procedure) on transmission/transaxle shafts; perform necessary action.
26. Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings.
27. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action.
28. Remove, inspect measure, adjust, and reinstall transaxle final drive pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly.
29. Inspect lubrication devices (oil pump or slingers); perform necessary action.
30. Inspect, test, and replace transmission/transaxle sensors and switches.
31. Describe the operational characteristics of an electronically controlled manual transmission/transaxle.
32. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.
33. Diagnose universal joint noise and vibration concerns; perform necessary action.
34. Remove and replace front wheel drive (FWD) front wheel bearing.
35. Inspect, service, and replace shafts, yokes, boots, and CV joints.
36. Inspect, service, and replace shaft center support bearings.
37. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.
38. Diagnose noise and vibration concerns; determine necessary action.
39. Diagnose fluid leakage concerns; determine necessary action.

40. Inspect and replace companion flange and pinion seal; measure companion flange runout.

41. Inspect ring gear and measure runout; determine necessary action.

42. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings.

43. Measure and adjust drive pinion depth.

44. Measure and adjust drive pinion bearing preload.

45. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types).

46. Check ring and pinion tooth contact patterns; perform necessary action.

47. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.

48. Reassemble and reinstall differential case assembly; measure runout; determine necessary action.

49. Diagnose noise, slippage, and chatter concerns; determine necessary action.

50. Clean and inspect differential housing; refill with correct lubricant and/or additive.

51. Inspect and reinstall limited slip differential components.

52. Measure rotating torque; determine necessary action.

53. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action.

54. Inspect and replace drive axle shaft wheel studs.

55. Remove and replace drive axle shafts.

56. Inspect and replace drive axle shaft seals, bearings, and retainers.

57. Measures drive axle flange runout and shaft end play; determine necessary action.

58. Diagnose four-wheel and all-wheel drive noise, vibration, and unusual steering concerns; determine necessary action.

59. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.

60. Remove and reinstall transfer case.

61. Disassemble, service, and reassemble transfer case and components.

62. Inspect front-wheel bearings and locking hubs; perform necessary action.

63. Check drive assembly seals and vents; check lube level.

64. Diagnose, test, adjust, and replace electrical/electronic components of four-wheel drive systems.

65. Identify concerns related to variations in tire circumference and/or final drive ratios.
Connections: *Common Core State Standards *KOSSA *Common Core Technical Standards *New Generation Science Standards *Post-Secondary: KCTCS AUT 130-131 *CTSO's – Skills USA/Ford AAA

Basic Fuel and Ignition Systems and Lab
Valid Course Codes:
Class: 470558

Course Description

This course presents the theory, component identification, application, operation, and the service and repair of the basic automotive ignition, fuel, and emission systems, including related components. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Students Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
3. Identify and interpret engine performance concern; determine necessary action.
4. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins
5. Locate and interpret vehicle and major component identification numbers.
6. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.
7. Perform cylinder power balance test; determine necessary action.
8. Perform cylinder cranking and running compression tests; determine necessary action.
9. Perform cylinder leakage test; determine necessary action.
10. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action.
11. Verify engine operating temperature; determine necessary action.
12. Verify correct camshaft timing.
13. Inspect and test ignition primary and secondary circuit wiring and solid state components; test ignition coil(s); perform necessary action
14. Check fuel for contaminants and quality; determine necessary action.

15. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.
16. Replace fuel filters.
17. Inspect and test fuel injectors.
18. Test the operation of turbocharger/supercharger systems; determine necessary action
19. Adjust valves on engines with mechanical or hydraulic lifters.
20. Remove and replace timing belt; verify correct camshaft timing.
21. Remove and replace thermostat and gasket/seal.
22. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.
23. Perform common fastener and thread repairs, to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert.
24. Perform engine oil and filter change.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS AUT 140-141
*CTSO's – Skills USA/Ford AAA

Emission Systems and Lab
Valid Course Codes:
Class: 470564

Course Description

This course presents the theory, component identification, application, operation, and the service and repair of advanced automotive ignition, fuel, and emission systems, including related components. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Student Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.
3. Locate and interpret vehicle and major component identification numbers.
4. Prepare 4 or 5-gas analyzer; inspect and prepare vehicle for test; obtain exhaust readings.
5. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.
6. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.
7. Perform exhaust system back-pressure test; determine necessary action.
8. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action.
9. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.
10. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action.
11. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action.
12. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.

13. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action.

14. Inspect and test mechanical components of secondary air injection systems; perform necessary action.

15. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.

16. Inspect and test catalytic converter efficiency.

17. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action.

18. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action.

19. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS AUT 142-143
*CTSO's – Skills USA/Ford AAA

Automotive Maintenance and Light Repair and Lab Sections A-B-C-D
Valid Course Codes:
Class A: 470507
Class B: 470509
Class C: 470511
Class D: 470513

Course Description

These courses introduce the student to the principles, theories, and concepts of Automotive Technology, and include instruction in the maintenance and light repair of Engines, Brake Systems, Electrical/Electronic Systems, Suspension and Steering Systems, Automatic and Manual Transmission/Transaxles, and Engine Performance Systems. In all areas, appropriate theory, safety, and support instruction will be taught and required for performing each task, including proper care and cleaning of customers vehicles. The instruction will also include identification and use of appropriate tools and testing/measurement equipment required to accomplish certain tasks. The student will also receive the necessary training to locate and use current reference and training materials from accepted industry publications and resources, and demonstrate the ability to write work orders. All Tasks for the Automotive Maintenance and Light Repair Sections A, B, C, and D are listed in the Automotive Maintenance and Light Repair Section A Task List. **Courses A, B, C and D can be completed in any sequence.**

Content/Processes

Students Will:

1. Identify general shop safety rules and procedures.
2. Utilize safe procedures for handling of tools and equipment.
3. Identify and use proper placement of floor jacks and jack stands.
4. Identify and use proper procedures for safe lift operation.
5. Utilize proper ventilation procedures for working within the lab/shop area.
6. Identify marked safety areas.
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
8. Identify the location and use of eye wash stations.
9. Identify the location of the posted evacuation routes.
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
11. Identify and wear appropriate clothing for lab/shop activities.
12. Secure hair and jewelry for lab/shop activities.
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.
14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).

15. Locate and demonstrate knowledge of material safety data sheets (MSDS).
16. Identify tools and their usage in automotive applications.
17. Identify standard and metric designation.
18. Demonstrate safe handling and use of appropriate tools.
19. Demonstrate proper cleaning, storage, and maintenance of tools and equipment.
20. Demonstrate proper use of precision measuring tools (i.e. micrometer, dial-indicator, and dial-caliper).
21. Identify information needed and the service requested on a repair order.
22. Identify purpose and demonstrate proper use of fender covers, mats.
23. Demonstrate use of the three C's (concern, cause, and correction).
24. Review vehicle service history.
25. Complete Work Order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
26. Ensure vehicle is prepared to return to customer per school/company policy (floor mats, steering wheel cover, etc.).
27. ENGINE REPAIR: Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.
28. Verify operation of the instrument panel engine warning indicators.
29. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.
30. Install engine covers using gaskets, seals, and sealers as required.
31. Remove and replace timing belt; verify correct camshaft timing.
32. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.
33. Identify hybrid vehicle internal combustion engine service precautions.
34. Adjust valves (mechanical or hydraulic lifters).
35. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, and heater core; determine necessary action.
36. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.
37. Remove, inspect, and replace thermostat and gasket/seal.
38. Inspect and test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.

39. Perform engine oil and filter change.

40. AUTOMATIC TRANSMISSION AND TRANSAXLE: Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins.

41. Check fluid level in a transmission or a transaxle equipped with a dip-stick.

42. Check fluid level in a transmission or a transaxle not equipped with a dip-stick.

43. Check transmission fluid condition; check for leaks.

44. Inspect, adjust, and replace external manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch.

45. Inspect for leakage at external seals, gaskets, and bushings.

46. Inspect power train mounts.

47. Drain and replace fluid and filter(s).

48. Describe the operational characteristics of a continuously variable transmission (CVT).

49. Describe the operational characteristics of a hybrid vehicle drive train.

50. MANUAL DRIVE TRAIN AND AXLES: Research applicable vehicle and service information, fluid type, vehicle service history, service precautions, and technical service bulletins.

51. Drain and refill manual transmission/transaxle and final drive unit.

52. Check fluid condition; check for leaks.

53. Check and adjust clutch master cylinder fluid level.

54. Check for system leaks.

55. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle.

56. Inspect, remove, and replace front wheel drive (FWD) bearings, hubs, and seals.

57. Inspect, service, and replace shafts, yokes, boots, and universal/CV joints.

58. Clean and inspect differential housing; check for leaks; inspect housing vent.

59. Check and adjust differential housing fluid level.

60. Drain and refill differential housing.

61. Inspect and replace drive axle wheel studs.

62. Inspect front-wheel bearings and locking hubs.

63. Check for leaks at drive assembly seals; check vents; check lube level.

64. SUSPENSION AND STEERING SYSTEMS: Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.

65. Disable and enable supplemental restraint system (SRS).

66. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.

67. Determine proper power steering fluid type; inspect fluid level and condition.

68. Flush, fill, and bleed power steering system.

69. Inspect for power steering fluid leakage; determine necessary action.

70. Inspect for power steering fluid leakage; determine necessary action.

71. Inspect and replace power steering hoses and fittings.

72. Replace power steering pump filter(s).

73. Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper.

74. Inspect tie rod ends (sockets); tie rod sleeves, and clamps.

75. Inspect upper and lower control arms, bushings, and shafts.

76. Inspect and replace rebound and jounce bumpers.

77. Inspect track bar, strut rods/radius arms, and related mounts and bushings.

78. Inspect upper and lower ball joints (with or without wear indicators).

79. Inspect suspension system coil springs and spring insulators (silencers).

80. Inspect suspension system torsion bars and mounts.

81. Inspect and replace front stabilizer bar (sway bar) bushings, brackets, and links.

82. Inspect strut cartridge or assembly.

83. Inspect front strut bearing and mount.

84. Inspect rear suspension system lateral links/arms (track bars), control (trailing) arms.

85. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.

86. Inspect, remove, and replace shock absorbers; inspect mounts and bushings.

87. Inspect electric power-assisted steering.

88. Identify hybrid vehicle power steering system electrical circuits and safety precautions.

89. Describe the function of the power steering pressure switch.

90. Perform pre-alignment inspection and measure vehicle ride height; determine necessary action.

91. Inspect tire condition; identify tire wear patterns; check for correct size and application (load and speed ratings) and adjust air pressure; determine necessary action.

92. Rotate tires according to manufacturer's recommendations.

93. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly (static and dynamic).

94. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.

95. Inspect tire and wheel assembly for air loss; perform necessary action.

96. Repair tire using internal patch.

97. Identify and test tire pressure monitoring systems (indirect and direct) for operation; verify operation of instrument panel lamps.

98. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system.

99. BRAKES: Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.

100. Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS).

101. Measure breaks pedal height, travel, and free play (as applicable); determine necessary action.

102. Check master cylinder for external leaks and proper operation.

103. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, loose fittings and supports; determine necessary action.

104. Select, handle, store, and fill brake fluids to proper level.

105. Identify components of brake warning light system.

106. Bleed and/or flush brake system.

107. Test brake fluid for contamination.

108. Remove, clean, inspect, and measure brake drum diameter; determine necessary action.

109. Refinish brake drum and measure final drum diameter; compare with specifications.

110. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.

111. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.

112. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; make final checks and adjustments.

113. Install wheel and torque lug nuts.

114. Remove and clean caliper assembly; inspect for leaks and damage/wear to caliper housing; determine necessary action.

115. Clean and inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action.

116. Remove, inspect, and replace pads and retaining hardware; determine necessary action.

117. Lubricate and reinstall caliper, pads, and related hardware; seat pads and inspect for leaks.

118. Clean and inspect rotor, measure rotor thickness, thickness variation, and lateral runout; determine necessary action.

119. Remove and reinstall rotor.

120. Refinish rotor on vehicle; measure final rotor thickness and compare with specifications.

121. Refinish rotor off vehicle; measure final rotor thickness and compare with specifications.

122. Retract and re-adjust caliper piston on an integral parking brake system.

123. Check brake pad wear indicator; determine necessary action.

124. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturer's recommendations.

125. Check brake pedal travel with, and without, engine running to verify proper power booster operation.

126. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.

127. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.

128. Check parking brake cables and components for wear, binding, and corrosion; clean, lubricate, adjust or replace as needed.

129. Check parking brake operation and parking brake indicator light system operation; determine necessary action.

130. Check operation of brake stop light system.

131. Replace wheel bearing and race.

132. Identify traction control/vehicle stability control system components.

133. Describe the operation of a regenerative braking system.

134. ELECTRICAL/ELECTRONIC SYSTEMS: Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.

135. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).

136. Use wiring diagrams to trace electrical/electronic circuits.

137. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance.

138. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.

139. Check operation of electrical circuits with a test light.

140. Check operation of electrical circuits with fused jumper wires.

141. Measure key-off battery drain (parasitic draw).

142. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.

143. Perform solder repair of electrical wiring.

144. Replace electrical connectors and terminal ends.

145. Perform battery state-of-charge test; determine necessary action.

146. Confirm proper battery capacity for vehicle application; perform battery capacity test; determine necessary action.

147. Maintain or restore electronic memory functions.

148. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs.

149. Perform slow/fast battery charge according to manufacturer's recommendations.

150. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.

151. Identify high-voltage circuits of electric or hybrid electric vehicle and related safety precautions.

152. Identify electronic modules, security systems, radios, and other accessories that require re-initialization or code entry after reconnecting vehicle battery.

153. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures.

154. Perform starter current draw test; determine necessary action.

155. Perform starter circuit voltage drop tests; determine necessary action.

156. Inspect and test starter relays and solenoids; determine necessary action.

157. Remove and install starter in a vehicle.

158. Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action.

159. Perform charging system output test; determine necessary action.

160. Inspect, adjust, or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.

161. Remove, inspect, and re-install generator (alternator).

162. Perform charging circuit voltage drop tests; determine necessary action.

163. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed.

164. Aim headlights.

165. Identify system voltage and safety precautions associated with high-intensity discharge headlights.

166. Disable and enable airbag system for vehicle service; verify indicator lamp operation.

167. Remove and reinstall door panel.

168. Describe the operation of keyless entry/remote-start systems.

169. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators.

170. Verify windshield wiper and washer operation; replace wiper blades.

171. HEATING AND AIR CONDITIONING: Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.

172. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action.

173. Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions.

174. Inspect A/C condenser for airflow restrictions; determine necessary action.

175. Inspect engine cooling and heater systems hoses; perform necessary action.

176. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; perform necessary action.

177. Identify the source of A/C system odors.

178. ENGINE PERFORMANCE: Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins.

179. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action

180. Perform cylinder power balance test; determine necessary action.

181. Perform cylinder cranking and running compression tests; determine necessary action.

182. Perform cylinder leakage test; determine necessary action.

183. Verify engine operating temperature.

184. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.

185. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable.

186. Describe the importance of operating all OBDII monitors for repair verification.

187. Replace fuel filter(s).

188. Inspect, service, or replace air filters, filter housings, and intake duct work.

189. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action.

190. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; repair or replace as needed.

191. Check and refill diesel exhaust fluid (DEF).

192. Inspect, test, and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary:
*CTSO's – Skills USA/Ford AAA

Suspension and Steering and Lab
Valid Course Codes:
Class: 470553

Course Description

This course presents the automotive suspension system, the diagnosing of suspension problems, identifying components, recognizing tire wear problems, wheel balancing, and the use of alignment equipment. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Students Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret suspension and steering system concerns; determine necessary action.
3. Research applicable vehicle and service information such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Disable and enable supplemental restraint system (SRS).
6. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).
7. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action.
8. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.
9. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.
10. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action.
11. Adjust non-rack and pinion worm bearing preload and sector lash.
12. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.

13. Inspect and replace rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.
14. Determine proper power steering fluid type; inspect fluid level and condition.
15. Flush, fill, and bleed power steering system.
16. Diagnose power steering fluid leakage; determine necessary action.
17. Remove, inspect, replace, and adjust power steering pump belt.
18. Remove and reinstall power steering pump.
19. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.
20. Inspect and replace power steering hoses and fittings.
21. Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper.
22. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.
23. Test and diagnose components of electronically controlled steering systems using a scan tool; determine necessary action.
24. Inspect and test electric power assist steering.
25. Identify hybrid vehicle power steering system electrical circuits, service and safety precautions.
26. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action.
27. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action.
28. Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers.
29. Remove, inspect and install strut rods and bushings.
30. Remove, inspect, and install upper and/or lower ball joints.
31. Remove, inspect, and install steering knuckle assemblies.
32. Remove, inspect, and install short and long arm suspension system coil springs and spring insulators.
33. Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts.
34. Remove, inspect, and install stabilizer bar bushings, brackets, and links.
35. Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.
36. Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts.

37. Inspect, remove, and replace shock absorbers.

38. Remove, inspect, and service or replace front and rear wheel bearings.

39. Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action.

40. Diagnose, inspect, adjust, repair or replace components of electronically controlled steering systems (including sensors, switches, and actuators); initialize system as required.

41. Describe the function of the idle speed compensation switch.

42. Lubricate suspension and steering systems.

43. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action.

44. Perform prealignment inspection and measure vehicle ride height; perform necessary action.

45. Prepare vehicle for wheel alignment on the alignment machine; perform four wheel alignment by checking and adjusting front and rear wheel caster, camber; and toe as required; center steering wheel.

46. Check toe-out-on-turns (turning radius); determine necessary action.

47. Check SAI (steering axis inclination) and included angle; determine necessary action.

48. Check rear wheel thrust angle; determine necessary action.

49. Check for front wheel setback; determine necessary action.

50. Check front and/or rear cradle (subframe) alignment; determine necessary action.

51. Inspect tire condition; identify tire wear patterns; check and adjust air pressure; determine necessary action.

52. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.

53. Rotate tires according to manufacturer's recommendations.

54. Measure wheel, tire, axle flange, and hub runout; determine necessary action.

55. Diagnose tire pull problems; determine necessary action.

56. Dismount, inspect, and remount tire on wheel; Balance wheel and tire assembly (static and dynamic).

57. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.

58. Reinstall wheel; torque lug nuts.

59. Inspect tire and wheel assembly for air loss; perform necessary action.

60. Repair tire using internal patch.

61. Inspect, diagnose, and calibrate tire pressure monitoring system.

Connections:
*Common Core State Standards *KOSSA *Common Core Technical Standards *New Generation Science Standards *Post-Secondary: KCTCS AUT 160-161 *CTSO's – Skills USA/Ford AAA

Automatic Transmission/Transaxle and Lab
Valid Course Codes:
Class: 470570

Course Description

This course involves the study of the operating principles of rear and front wheel drive automatic transmissions and transaxles, and the testing and diagnostic process. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task, including proper care and cleaning of customers vehicles. 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information

Content/Processes

Student Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Identify and interpret transmission/transaxle concern; differentiate between engine performance and transmission/transaxle concerns; determine necessary action.
3. Research applicable vehicle and service information, such as transmission/transaxle system operation, fluid type, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Diagnose fluid loss and condition concerns; check fluid level in transmissions with and without dip-stick; determine necessary action.
6. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action.
7. Perform stall test; determine necessary action.
8. Perform lock-up converter system tests; determine necessary action.
9. Diagnose noise and vibration concerns; determine necessary action.
10. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.
11. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).
12. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.
13. Inspect, adjust, and replace manual valve shift linkage, transmission range sensor/switch, and park/neutral position switch.

14. Inspect and replace external seals, gaskets, and bushings.
15. Inspect, test, adjust, repair, or replace electrical/electronic components and circuits, including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses.
16. Diagnose electronic transmission control systems using a scan tool; determine necessary action.
17. Inspect, replace, and align powertrain mounts.
18. Service transmission; perform visual inspection; replace fluid and filters.
19. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces.
20. Disassemble, clean, and inspect transmission/transaxle.
21. Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, sleeves, retainers, brackets, check-valves/balls, screens, spacers, and gaskets).
22. Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine necessary action.
23. Assemble transmission/transaxle.
24. Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings.
25. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.
26. Install and seat torque converter to engage drive/splines.
27. Inspect, measure, and reseal oil pump assembly and components
28. Measure transmission/transaxle end play or preload; determine necessary action.
29. Inspect, measure, and replace thrust washers and bearings.
30. Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls.
31. Inspect bushings; determine necessary action.
32. Inspect and measure planetary gear assembly components; determine necessary action.
33. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action.
34. Inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action.
35. Inspect, measure, repair, adjust or replace transaxle final drive components.
36. Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates; determine necessary action.

37. Measure clutch pack clearance; determine necessary action.

38. Air test operation of clutch and servo assemblies.

39. Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers; determine necessary action.

40. Inspect bands and drums; determine necessary action.

41. Describe the operational characteristics of a continuously variable transmission (CVT)

42. Describe the operational characteristics of a hybrid vehicle drive train.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS AUT 180-181
*CTSO's – Skills USA/Ford AAA

Automobile Service Technology and Lab Sections A-B-C-D
Valid Course Codes:
Class A: 470515
Class B: 470517
Class C: 470519
Class D: 470521

Course Description

These courses present the theory, component identification, operation, diagnosis, and the service and repair of Engines, Brake Systems, Electrical/Electronic Systems, Suspension and Steering Systems, Automatic and Manual Transmission/Transaxles, and Engine Performance Systems. In all areas, appropriate theory, safety, and support instruction will be taught and required for performing each task. The instruction will also include identification and use of appropriate tools and testing/measurement equipment required to accomplish certain tasks. The student will also locate and use current reference and training materials from accepted industry publications and resources, and write industry standard work orders. All tasks for Automobile Service Technology Sections A, B, C, and D are listed in AUT 182 Automobile Service Technology Section A. Courses A, B, C and D can be completed in any sequence.

Prerequisite: Completion of all Automotive Maintenance and Light Repair Courses (Sections A, B, C, and D)

Content/Processes

Students Will:

1. Identify general shop safety rules and procedures.
2. Utilize safe procedures for handling of tools and equipment.
3. Identify and use proper placement of floor jacks and jack stands.
4. Identify and use proper procedures for safe lift operation.
5. Utilize proper ventilation procedures for working within the lab/shop area.
6. Identify marked safety areas.
7. Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.
8. Identify the location and use of eye wash stations.
9. Identify the location of the posted evacuation routes.
10. Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.
11. Identify and wear appropriate clothing for lab/shop activities.
12. Secure hair and jewelry for lab/shop activities.
13. Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.

14. Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).

15. Locate and demonstrate knowledge of material safety data sheets (MSDS).

16. ENGINE REPAIR: Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.

17. Inspect, remove and replace engine mounts.

18. Remove and re-install engine in an OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition.

19. Remove cylinder head; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer's specifications and procedures.

20. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition.

21. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action.

22. Inspect and replace camshaft and drive belt/chain; includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and valve timing components; verify correct camshaft timing.

23. Establish camshaft position sensor indexing.

24. Remove, inspect, or replace crankshaft vibration damper (harmonic balancer).

25. Identify causes of engine overheating.

26. Inspect, remove, and replace water pump.

27. Remove and replace radiator.

28. Inspect and test fan(s) (electrical or mechanical), fan clutch, fan shroud, and air dams.

29. Perform oil pressure tests; determine necessary action.

30. Inspect auxiliary coolers; determine necessary action.

31. Inspect, test, and replace oil temperature and pressure switches and sensors.

32. AUTOMATIC TRANSMISSION AND TRANSAXLE: Identify and interpret transmission/transaxle concern, differentiate between engine performance and transmission/transaxle concerns; determine necessary action.

33. Diagnose fluid loss and condition concerns; determine necessary action.

34. Perform stall test; determine necessary action.

35. Perform lock-up converter system tests; determine necessary action.

36. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.

37. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law).

38. Inspect for leakage; replace external seals, gaskets, and bushings.

39. Inspect, test, adjust, repair, or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses.

40. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mating surfaces.

41. Inspect, leak test, and flush or replace transmission/transaxle oil cooler, lines, and fittings.

42. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore.

43. MANUAL DRIVE TRAIN AND AXLES: Identify and interpret drive train concerns; determine necessary action.

44. Check fluid condition; check for leaks; determine necessary action.

45. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.

46. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action.

47. Inspect and replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing and linkage, and pilot bearing/bushing (as applicable).

48. Bleed clutch hydraulic system.

49. Inspect flywheel and ring gear for wear and cracks; determine necessary action.

50. Measure flywheel runout and crankshaft end play; determine necessary action.

51. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers.

52. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.

53. Diagnose universal joint noise and vibration concerns; perform necessary action.

54. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles.

55. Inspect and replace companion flange and pinion seal; measure companion flange runout.

56. Remove and replace drive axle shafts.

57. Inspect and replace drive axle shaft seals, bearings, and retainers.

58. Measure drive axle flange runout and shaft end play; determine necessary action.

59. Four-wheel Drive/All-wheel Drive: Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.

60. Inspect front-wheel bearings and locking hubs; perform necessary action(s).

61. Identify concerns related to variations in tire circumference and/or final drive ratios.

62. Clean and inspect differential housing; check for leaks; inspect housing vent.

63. Check and adjust differential housing fluid level.

64. Drain and refill differential housing.

65. Check for leaks at drive assembly seals; check vents; check lube level.

66. SUSPENSION AND STEERING: Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).

67. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action.

68. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.

69. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine necessary action.

70. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action.

71. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets.

72. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed.

73. Remove and reinstall power steering pump.

74. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment.

75. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.

76. Identify hybrid vehicle power steering system electrical circuits and safety precautions.

77. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine necessary action.

78. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine necessary action.

79. Inspect, remove and install upper and lower control arms, bushings, shafts, and rebound bumpers.

80. Inspect, remove and install strut rods and bushings.

81. Inspect, remove and install upper and/or lower ball joints (with or without wear indicators).

82. Inspect, remove and install steering knuckle assemblies.

83. Inspect, remove and install short and long arm suspension system coil springs and spring insulators.

84. Inspect, remove and install torsion bars and mounts.

85. Inspect, remove and install front stabilizer bar (sway bar) bushings, brackets, and links.

86. Inspect, remove and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.

87. Inspect, remove and install track bar, strut rods/radius arms, and related mounts and bushings.

88. Inspect rear suspension system leaf spring(s), bushings, center pins/bolts, and mounts.

89. Remove, inspect, and service or replace front and rear wheel bearings.

90. Describe the function of the power steering pressure switch.

91. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action.

92. Perform pre-alignment inspection and measure vehicle ride height; perform necessary action.

93. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber; and toe as required; center steering wheel.

94. Check toe-out-on-turns (turning radius); determine necessary action.

95. Check SAI (steering axis inclination) and included angle; determine necessary action.

96. Check rear wheel thrust angle; determine necessary action.

97. Check for front wheel setback; determine necessary action.

98. Check front and/or rear cradle (subframe) alignment; determine necessary action.

99. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.

100. Measure wheel, tire, axle flange, and hub runout; determine necessary action.

101. Diagnose tire pull problems; determine necessary action.

102. BRAKES: Identify and interpret brake system concerns; determine necessary action.

103. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's Law).

104. Check master cylinder for internal/external leaks and proper operation; determine necessary action.

105. Remove, bench bleed, and reinstall master cylinder.

106. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action.

107. Replace brake lines, hoses, fittings, and supports.

108. Fabricate brake lines using proper material and flaring procedures (double flare and ISO)

109. Inspect, test, and/or replace components of brake warning light system.

110. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.

111. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pulsation concerns; determine necessary action.

112. Inspect vacuum-type power booster unit for leaks; inspect the check-valve for proper operation; determine necessary action.

113. Inspect and test hydraulically-assisted power brake system for leaks and proper operation; determine necessary action.

114. Measure and adjust master cylinder pushrod length.

115. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action.

116. Remove and reinstall sealed wheel bearing assembly.

117. Identify and inspect electronic brake control system components; determine necessary action.

118. ELECTRICAL/ELECTRONIC SYSTEMS: Use wiring diagrams during the diagnosis (troubleshooting) of electrical/electronic circuit problems.

119. Diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.

120. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; determine necessary action.

121. Repair wiring harness.

122. Differentiate between electrical and engine mechanical problems that cause a slow-crank or a no-crank condition.

123. Diagnose (troubleshoot) charging system for causes of undercharge, no-charge, or overcharge conditions.

124. Diagnose (troubleshoot) the causes of brighter-than-normal, intermittent, dim, or no light operation; determine necessary action.

125. Inspect and test gauges and gauge sending units for causes of abnormal gauge readings; determine necessary action.

126. Diagnose (troubleshoot) the causes of incorrect operation of warning devices and other driver information systems; determine necessary action.

127. Diagnose (troubleshoot) causes of incorrect horn operation; perform necessary action.

128. Diagnose (troubleshoot) causes of incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.

129. Diagnose (troubleshoot) windshield washer problems; perform necessary action.

130. Diagnose (troubleshoot) incorrect operation of motor-driven accessory circuits; determine necessary action.

131. Diagnose (troubleshoot) incorrect electric lock operation (including remote keyless entry); determine necessary action.

132. Diagnose (troubleshoot) incorrect operation of cruise control systems; determine necessary action.

133. Diagnose (troubleshoot) supplemental restraint system (SRS) problems; determine necessary action.

134. Check for module communication errors (including CAN/BUS systems) using a scan tool.

135. HEATING AND AIR CONDITIONING: Identify and interpret heating and air conditioning problems; determine necessary action.

136. Performance test A/C system; identify problems.

137. Identify abnormal operating noises in the A/C system; determine necessary action.

138. Identify refrigerant type; select and connect proper gauge set; record temperature and pressure readings.

139. Leak test A/C system; determine necessary action.

140. Inspect condition of refrigerant oil removed from A/C system; determine necessary action.

141. Determine recommended oil and oil capacity for system application.

142. Using a scan tool, observe and record related HVAC data and trouble codes.

143. Inspect, test, service or replace A/C compressor clutch components and/or assembly; check compressor clutch air gap; adjust as needed.

144. Remove, inspect, and reinstall A/C compressor and mountings; determine recommended oil quantity.

145. Determine need for an additional A/C system filter; perform necessary action.

146. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action.

147. Inspect A/C condenser for airflow restrictions; perform necessary action.

148. Remove, inspect, and reinstall receiver/drier or accumulator/drier; determine recommended oil quantity.

149. Remove, inspect, and install expansion valve or orifice (expansion) tube.

150. Inspect evaporator housing water drain; perform necessary action.

151. Inspect and test heater control valve(s); perform necessary action.

152. Inspect and test A/C-heater blower motors, resistors, switches, relays, wiring, and protection devices; perform necessary action.

153. Diagnose A/C compressor clutch control systems; determine necessary action.

154. Diagnose malfunctions in the vacuum, mechanical, and electrical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.

155. Inspect and test A/C-heater control panel assembly; determine necessary action.

156. Inspect and test A/C-heater control cables, motors, and linkages; perform necessary action.

157. Check operation of automatic or semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action.

158. Perform correct use and maintenance of refrigerant handling equipment according to equipment manufacturer's standards.

159. Identify and recover A/C system refrigerant.

160. Recycle, label, and store refrigerant.

161. Evacuate and charge A/C system; add refrigerant oil as required.

162. ENGINE PERFORMANCE: Identify and interpret engine performance concerns; determine necessary action.

163. Diagnose abnormal engine noises or vibration concerns; determine necessary action.

164. Diagnose abnormal exhaust color, odor, and sound; determine necessary action.

165. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action.

166. Verify engine operating temperature; determine necessary action.

167. Verify correct camshaft timing.

168. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable.

169. Access and use service information to perform step-by-step (troubleshooting) diagnosis.

170. Perform active tests of actuators using a scan tool; determine necessary action.

171. Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action.

172. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action.

173. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary.

174. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.

175. Check fuel for contaminants; determine necessary action.

176. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action.

177. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.

178. Inspect and test fuel injectors.

179. Verify idle control operation.

180. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform necessary action.

181. Perform exhaust system back-pressure test; determine necessary action.

182. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action.

183. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action.

184. Inspect, test, service, and replace components of the EGR system including tubing, exhaust passages, vacuum/pressure controls, filters, and hoses; perform necessary action.

185. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.

186. Inspect and test catalytic converter efficiency.

187. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action.

188. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary:
*CTSO's – Skills USA/Ford AAA

Master Automobile Service Technology and Lab Sections A and B
Valid Course Codes:
Class A: 470523
Class B: 470525

Course Description

This advanced automotive course presents the theory, component identification, operation, diagnosis, and the service and repair of Engines and Engine Systems, Brake Systems, Electrical/Electronic Systems, Suspension and Steering Systems, Automatic and Manual Transmission/Transaxles, and Engine Performance Systems. In all areas, appropriate theory, safety, and support instruction will be taught and required for performing each task. The instruction will also include identification and use of appropriate tools and testing/measurement equipment required to accomplish certain tasks. The student will also locate and use current reference and training materials from accepted industry publications and resources, and write industry standard work orders which include information regarding problem resolution and the results of the work performed. All tasks for Master Automobile Service Technology Sections A and B are listed here. Prerequisite: Completion of all Automotive Service Technology Courses and all Automotive Maintenance and Light Repair Courses. Courses A and B can be taken in any sequence.

Content/Process

Students Will:

1. AUTOMATIC TRANSMISSION AND TRANSAXLE: Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine necessary action.
2. Diagnose noise and vibration concerns; determine necessary action.
3. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information.
4. Disassemble, clean, and inspect transmission/transaxle.
5. Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, sleeves, retainers, brackets, checkvalves/balls, screens, spacers, and gaskets).
6. Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine necessary action.
7. Assemble transmission/transaxle.
8. Inspect, measure, and reseal oil pump assembly and components.
9. Measure transmission/transaxle end play or preload; determine necessary action.
10. Inspect, measure, and replace thrust washers and bearings.
11. Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls.
12. Inspect bushings; determine necessary action.
13. Inspect and measure planetary gear assembly components; determine necessary action.

14. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action.
15. Diagnose and inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action.
16. Inspect, measure, repair, adjust or replace transaxle final drive components.
17. Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates, bands and drums; determine necessary action.
18. Measure clutch pack clearance; determine necessary action.
19. Air test operation of clutch and servo assemblies.
20. Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, retainers; determine necessary action.
21. Manual Drive Train And Axles: Diagnose noise concerns through the application of transmission/transaxle powerflow principles.
22. Diagnose hard shifting and jumping out of gear concerns; determine necessary action.
23. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action.
24. Diagnose noise and vibration concerns; determine necessary action.
25. Diagnose noise, slippage, and chatter concerns; determine necessary action.
26. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage
27. Diagnose noise, vibration, and unusual steering concerns; determine necessary action.
28. Diagnose, test, adjust, and replace electrical/electronic components of four-wheel drive systems.
29. Disassemble, inspect clean, and reassemble internal transmission/transaxle components.
30. Inspect ring gear and measure runout; determine necessary action.
31. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings.
32. Measure and adjust drive pinion depth.
33. Measure and adjust drive pinion bearing preload.
34. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types).
35. Check ring and pinion tooth contact patterns; perform necessary action.

36. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.

37. Reassemble and re-install differential case assembly; measure runout; determine necessary action.

38. Measure rotating torque; determine necessary action.

39. Disassemble, service, and reassemble transfer case and components.

40. SUSPENSION AND STEERING: Identify and interpret suspension and steering system concerns; determine necessary action.

41. Test and diagnose components of electronically-controlled steering systems using a scan tool; determine necessary action.

42. BRAKES: Diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine necessary action.

43. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action.

44. Depressurize high-pressure components of an electronic brake control system.

45. Bleed the electronic brake control system hydraulic circuits

46. Test, diagnose, and service electronic brake control system speed sensors (digital and analog), toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data).

47. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.).

48. Inspect and replace wheel studs.

49. ELECTRICAL/ELECTRONIC SYSTEMS: Check electrical/electronic circuit waveforms; interpret readings and determine needed repairs.

50. Repair wiring harness (including CAN/BUS systems).

51. Diagnose (troubleshoot) radio static and weak, intermittent, or no radio reception; determine necessary action.

52. Diagnose (troubleshoot) body electronic system circuits using a scan tool; determine necessary action.

53. Diagnose the cause(s) of false, intermittent, or no operation of anti-theft systems.

54. Perform software transfers, software updates, or flash reprogramming on electronic modules.

55. HEATING AND AIR CONDITIONING: Diagnose temperature control problems in the heater/ventilation system; determine necessary action.

56. Determine procedure to remove and re-install evaporator; determine required oil quantity.

57. Remove, inspect, and re-install condenser; determine required oil quantity.

58. Determine procedure to remove, inspect, and re-install heater core.

59. ENGINE PERFORMANCE: Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data.

60. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action.

61. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action.

62. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM installed accessories, or similar systems); determine necessary action.

63. Diagnose (troubleshoot) hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine necessary action.

64. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action.

65. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action.

66. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.

67. Test the operation of turbocharger/supercharger systems; determine necessary action.

68. ENGINE REPAIR: Inspect valve springs for squareness and free height comparison; determine necessary action.

69. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action.

70. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action.

71. Inspect valves and valve seats; determine necessary action.

72. Check valve spring assembled height and valve stem height; determine necessary action.

73. Inspect valve lifters; determine necessary action

74. Inspect and/or measure camshaft for runout, journal wear and lobe wear.

75. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action.

76. Disassemble engine block; clean and prepare components for inspection and reassembly.

77. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action.

78. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action.

79. Deglaze and clean cylinder walls.

80. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.

81. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action.

82. Inspect main and connecting rod bearings for damage and wear; determine necessary action.

83. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action.

84. Inspect and measure piston skirts and ring lands; determine necessary action

85. Determine piston-to-bore clearance.

86. Inspect, measure, and install piston rings

87. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time.

88. Assemble engine block.

89. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary:
*CTSO's – Skills USA/Ford AAA

Automotive Internship I
Valid Course Codes:
Class: 470504

Course Description

Internship for CTE courses provide supervised work-site experience for high school students who are enrolled in a capstone course associated with their identified career pathway. Internship experiences consist of a combination of classroom instruction and field experiences. A student receiving pay for an intern experience is one who is participating in an experience that lasts a semester or longer and has an established employee-employer relationship. A non-paid internship affects those students who participate on a short-term basis (semester or less).

Content/Process

Students Will:

1. Gain career awareness and the opportunity to test career choice(s).
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS AUT 198-298/198-298
CTSO's – Skills USA/Ford AAA

Cooperative Education I
Valid Course Codes:
Class: 470501

Course Description

Co-op provides supervised on-the-job work experience related to the student's educational objectives. Students who participate in the Cooperative Education program receive compensation for their work.

Prerequisites: Consent of Instructor

Content/Process

Students Will

1. Gain career awareness and the opportunity to test career choice(s).
2. Receive work experience related to career interests prior to graduation.
3. Integrate classroom studies with work experience.
4. Receive exposure to facilities and equipment unavailable in a classroom setting.
5. Increase employability potential after graduation.
6. Earn funds to help finance education expenses.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS AUT 199-299
*CTSO's – Skills USA/Ford AAA

Computer Control Systems and Diagnosis and Lab
Valid Course Codes:
Class: 470560

This course presents the comprehensive diagnostics of on-board computer control systems. The problem solving process, including flow chart reading, will be presented. It is assumed that: 1. In all areas, appropriate theory, safety, and support instruction will be required for performing each task; 2. The instruction has included identification and use of appropriate tools and testing and measurement equipment required to accomplish certain tasks; 3. The student has received the necessary training to locate and use current reference and training materials from accepted industry publications and resources; 4. In all areas, the student has demonstrated the ability to write work orders and warranty reports, to include information regarding problem resolution and the results of the work performed for the customer and manufacturer. The writing process will incorporate the "Three C's" (concern, cause and correction) as a format to communicate this information. Prerequisites: AUT 142 and AUT 143 Co-requisites: AUT 241

Content/Process

Students Will:

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.
2. Diagnose abnormal engine noise or vibration problems; determine necessary action
3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.
4. Locate and interpret vehicle and major component identification numbers.
5. Diagnose abnormal exhaust color, odor, and sound; determine necessary action.
6. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable.
7. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data.
8. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action.
9. Check for module communication (including CAN/BUS systems) errors using a scan tool.
10. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action.
11. Access and use service information to perform step-by-step diagnosis.
12. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems); determine necessary action.
13. Perform active tests of actuators using a scan tool; determine necessary action.

14. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action.

15. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action.

16. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary.

17. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine necessary action.

18. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.

19. Identify hybrid vehicle internal combustion engine service precautions.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS AUT 240-241
*CTSO's – Skills USA/Ford AAA

Special Problems I, II, III, IV (Auto)
Valid Course Codes:
Class A: 470577
Class B: 470578
Class C: 470479
Class D: 470584

Course Description
Courses designed to enhance a student's understanding of shop situations and problems that arise when dealing with live work. It expands on the task lists that have already been taught to the student in **previous** Auto Courses. The instructor will teach students how to deal with real world problems that arise when repairing automobiles subjected to various types of customer road use. **Prerequisite: Completion of the Automotive Maintenance and Light Repair Courses/Sections A, B, C and D.**
Content/Process
Students Will: 1. Diagnose and repair selected task/problems as determined by the instructor.
Connections:
*Common Core State Standards *KOSSA *Common Core Technical Standards *New Generation Science Standards *Post-Secondary: KCTCS AUT 290-291-293 *CTSO's – Skills USA/Ford AAA

Personal Financial Management
Valid Course Code:
060170

Course Description

Information needed to make intelligent choices and take effective action in the management of personal resources is provided. Topics include financial planning, buying, borrowing, saving, budgeting, investing, insurance, and taxes to personal finances.

Content/Process

Students Will:

1. Compare major economic systems in the global economy.
2. Identify sources of consumer information, protection, rights, and responsibilities.
3. Describe the characteristics and services of financial institutions.
4. Demonstrate the use of personal financial statements, budgets, and other financial tools to evaluate financial health.
5. Identify options available for managing cash and liquid assets.
6. Identify investment opportunities.
7. Compare and evaluate consumer credit.
8. Develop strategies for making smart buying decisions with regard to housing, transportation, and consumer goods.
9. Identify major types of employee benefits.
10. Complete various types of tax forms.
11. Explain basic tax concepts and effective tax minimization strategies.
12. Identify and compare basic types of health, life, auto and homeowner/renter insurance.
13. Explain the basic financial markets and investment options.
14. Explain and discuss contingency planning, including retirement and estate planning.
15. Compute various financial transactions, such as account reconciliation, interest, capital gains, etc.
16. Identify ergonomics and understand why ergonomics is important from a health point of view.
17. Demonstrate accountability of and the safe and responsible use of company resources, office equipment, machines, etc.
18. Apply Internet etiquette and safety.
19. Identify safety rules applicable to this course and demonstrate appropriate observance of said rules, including but not limited to, trip hazards, electrical cords and outlets, evacuation procedures for emergency situations (including fire, tornado, bomb threat, earthquake, etc.), lockdown procedures for emergency situations, location and contents of first aid kit, MSDS sheets, etc.

Connections:

*Common Core State Standards
*KOSSA
*Post-Secondary: KCTCS: BAS 120

Industrial Safety
Valid Course Code:
460301

Course Description

This course provides practical training in industrial safety. The students are taught to observe general safety rules and regulations, to apply work site and shop safety rules, and to apply OSHA regulations. Students are expected to obtain certification in first aid and cardiopulmonary resuscitation.

Content/Process

Students Will:

1. Apply work site and lab safety procedures.
2. Apply personal safety rules and procedures.
3. Apply fire prevention rules and procedures.
4. Obtain first aid certification.
5. Obtain CPR certification.
6. Demonstrate hazardous communications procedures.
7. Describe and demonstrate universal precautions procedures.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*Post-Secondary: KCTCS: ISX 100

Precision Measurement
Valid Course Code:
470546

Course Description

This class introduces the student to the basic fundamentals of precision measurement and its application in the industrial setting.

Content/Process

Students Will:

1. Measure with an English fraction rule.
2. Measure with an English decimal rule.
3. Measure with a metric steel rule.
4. Read an English vernier caliper and height gauge scale.
5. Read a metric vernier caliper and height gauge scale.
6. Read an English micrometer.
7. Read a metric micrometer.
8. Assemble English gauge blocks to specified measurements.
9. Assemble metric gauge blocks to specified measurements.
10. Use hole and plug gauges to check hole diameters.
11. Use thread gages to check thread dimensions.
12. Read and use various dial indicators.
13. Identify pneumatic, electrical, electronic, and optical comparators.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*New Generation Science Standards
*Post-Secondary: KCTCS PMX 100
*CTSO's – Skills USA/Ford AAA

Shop Management
Valid Course Code:
470301

Course Description

Introduces the basic principles of sound and efficient shop management. Inventory control, fiscal management, and customer relations are emphasized.

Content/Process

Students Will:

1. Maintain tools/equipment.
2. Develop customer relations skills.
3. Prepare work orders.
4. Maintain inventory.
5. Maintain service records.
6. Supervise personnel.
7. Prepare parts requisition.
8. Provide fiscal management.
9. Complete an incident report.

Connections:

*Common Core State Standards
*KOSSA
*Common Core Technical Standards
*Post-Secondary: KCTCS SMX 100
*CTSO's – Skills USA

Workplace Principles
Valid Course Code:
060191

Course Description

Workplace Principles examine the changing workforce and the skills needed to adapt to constantly changing demands and expectations. The course includes, but is not limited to, problem solving, teamwork, time management, and self-management skills. Job-seeking and job-retention skills are taught through the development of resumes and job search materials. Maximum benefit is received if this course is taken in the latter part of the student's course work.

Content/Process

Students Will:

1. Describe and apply the problem-solving processes independently and in groups.
2. Describe the importance of teamwork and apply teamwork skills.
3. Identify barriers to full team participation (sexual harassment, diversity, Americans with Disabilities Act, inhibiting behaviors)
4. Apply conflict resolution skills in team situations (i.e., workplace violence)
5. Describe the importance of time and self-management in the workplace.
6. Describe personal performance skills (i.e., appropriate dress, business protocol, personality traits, customer relations skills, and professional behavior)
7. Describe the steps to take advantage of transition opportunities (i.e., lifestyle change, employment change)
8. Develop an employment portfolio including a cover letter, resume, and reference page.
9. Identify sources for job leads and employer contacts.
10. Complete application forms.
11. Prepare and practice for job interviews.
12. Practice job follow-up strategies (job acceptance and job rejection)
13. Review pre-employment tests.
14. Identify policies and procedures for a drug-free workplace, workers' compensation, Family Medical Leave Act, grievance policy, unemployment compensation, and business ethics.
15. Identify ergonomics and understand why ergonomics is important from a health point of view.
16. Demonstrate accountability of and the safe and responsible use of company resources, office equipment, machines, etc.
17. Apply Internet etiquette and safety.

18.	Identify safety rules applicable to this course and demonstrate appropriate observance of said rules, including but not limited to, trip hazards, electrical cords and outlets, evacuation procedures for emergency situations (including fire, tornado, bomb threat, earthquake, etc.), lockdown procedures for emergency situations, location and contents of first aid kit, MSDS sheets, etc.

Connections:

*Common Core State Standards
*KOSSA
*Post-Secondary: KCTCS WPP 200
CTSO's – Skills USA